MPR 8730.4
REVISION D
EFFECTIVE DATE: September 19, 2004
EXPIRATION DATE: September 19, 2009

MARSHALL PROCEDURAL REQUIREMENTS

QD01

STATISTICAL TECHNIQUES

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		5/14/99	Document converted from MSFC-P20.1 to a Directive. Previous history retained in system as part of canceled or superseded ISO Document files.
Revision	A	8/16/99	Document changed to reflect new MSFC reorganization.
Revision	B	6/15/00	Document changed to reflect cancellation of MPG 1441.1, which was consolidated into MPG 1440.2, "MSFC Records Management Program".
Revision	C	5/12/2003	P.2 Broadened applicability, including covering cases specifically mentioned in ISO 9000-2000 document. Included requirement for use if mandate exists. P.4 Included reference to MPG8730.1. Inserted reference to Juran. Section 2 Inserted more explicit and stronger references to planning and mandated statistical analysis. Inserted explicit requirement to record use of statistical techniques in a permanent record, if such records are used. Inserted reference to 8730.1. Section 3 Enlarged optional QS01 role to cover any step covered in this document, and explicitly during planning, analysis or interpretation. Inserted section 3.2 that more explicitly describes a planning step. Section 5 Changed flow diagram to reflect changes in Section 3. Made reference to availability of QS01 assistance. Noted that planning sometimes occurs after data collection.
Revision	D	9/19/2004	Document typeface converted. Replaced instances of "Marshall Procedures and Guidelines" and "MPG" with "Marshall Procedural Requirements" and "MPR". Replaced instances of"QS" with "QD". P.2 d put in short explanation on use of statistics in sampling plans. P.5 updated reference in Juran and added reference to section on sampling. Sections 2 and 3 indicated requirements unambiguously by the use of "shall". 2.4 inserted "or other procedures" at end of section. Added appendix.

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PREFACE

P.1 PURPOSE

This Marshall Procedural Requirements (MPR) provides a consistent method for applying statistical techniques used in data analysis or interpretation, and specifically in establishing, controlling, and verifying process capability and product characteristics, when the use of statistics is required or statistics are otherwise employed by an organization.

P.2 APPLICABILITY

This MPR is applicable to organizations that identify a requirement for the use of statistical techniques. Statistical Techniques could be used in any case in which data analysis or interpretation is useful, and specifically could be used when establishing, controlling, and verifying process capability and product characteristics. According to the nature of the product and depending on the specified requirements, statistical techniques may be used to support:

a. Design verification (e.g., reliability, maintainability, safety);

b. Process control:
- Selection and inspection of key characteristics
- Process capability measurements
- Statistical process control
- Design of Experiments;

c. Failure mode and effect analysis (FMEA);

d. Inspection – matching sampling rate to the criticality of the product and to the process capability. It is important to note that whenever an inspection sample size less than 100%, is determined, and occasionally when apparent 100% sampling is used, the use of statistics is implied.

This list is not intended to be exhaustive. Statistical Techniques shall be used when specified by Contract or Project Management.

P.3 AUTHORITY

MPD 1280.1, “Marshall Management Manual”

P.4 APPLICABLE DOCUMENTS

a. MPD 1280.1, “Marshall Management Manual”

b. MPR 1440.2, “MSFC Records Management Program”

c. MPR 8730.1, "Inspection and Testing"

P.5 REFERENCES

Juran's Quality Control Handbook -- refer esp. to sections on "Basic Statistical Methods – Sources and Summarization of Data" and "Acceptance Sampling" (Pgs. 44.1 and 46.1 respectively in Fifth Edition, Juran/ Godfrey, Editors; copyright 1998, McGraw-Hill, pubs.)

P.6 CANCELLATION

MPR 8730.4C dated May 12, 2003

Original signed by
Robin N. Henderson for

David A. King
Director

DOCUMENT CONTENT

1. DEFINITIONS

1.1 Statistical Techniques (ST). Mathematical techniques used to interpret data.

1.2 Statistical Techniques User (STU). Any individual(s) who is responsible for performing statistical techniques to establish, verify, and control process capability and product characteristics.

2. RESPONSIBILITIES

2.1 MSFC organizations shall be responsible for:

2.1.1 Identifying the requirement to use and/or the appropriateness of the use of statistical techniques

2.1.2 Determining if the organization has capability to plan for and/or perform an analysis

2.1.3 Contacting QD01 if assistance is needed

2.1.4 Implementing and controlling the application of the statistical techniques

2.2 The statistical techniques user (STU) shall be responsible for identifying required and/or appropriate statistical techniques and methods, applying the appropriate techniques to the data, and issuing reports on the results of the statistical techniques.

2.3 If a specially published or mandated statistical procedure is used, reference to that procedure shall be noted by the STU in the appropriate permanent record of any analysis, if that record exists. As an example, if a sampling plan is constructed using ANSI/ ASQC Z1.9, reference to that document shall be preserved within the analysis record.

2.4 If a sampling plan is developed, it shall be tied by the STU either to an established document that circumscribes the method used to develop the plan or to a reasonable and statistically acceptable method from which the plan is derived. The document or method used shall be recorded with the sampling plan, if a record is kept. Sampling plans may be used or required under a process stemming from application of MPR 8730.1, “Inspection and Testing” or other procedures.

3. PROCEDURE

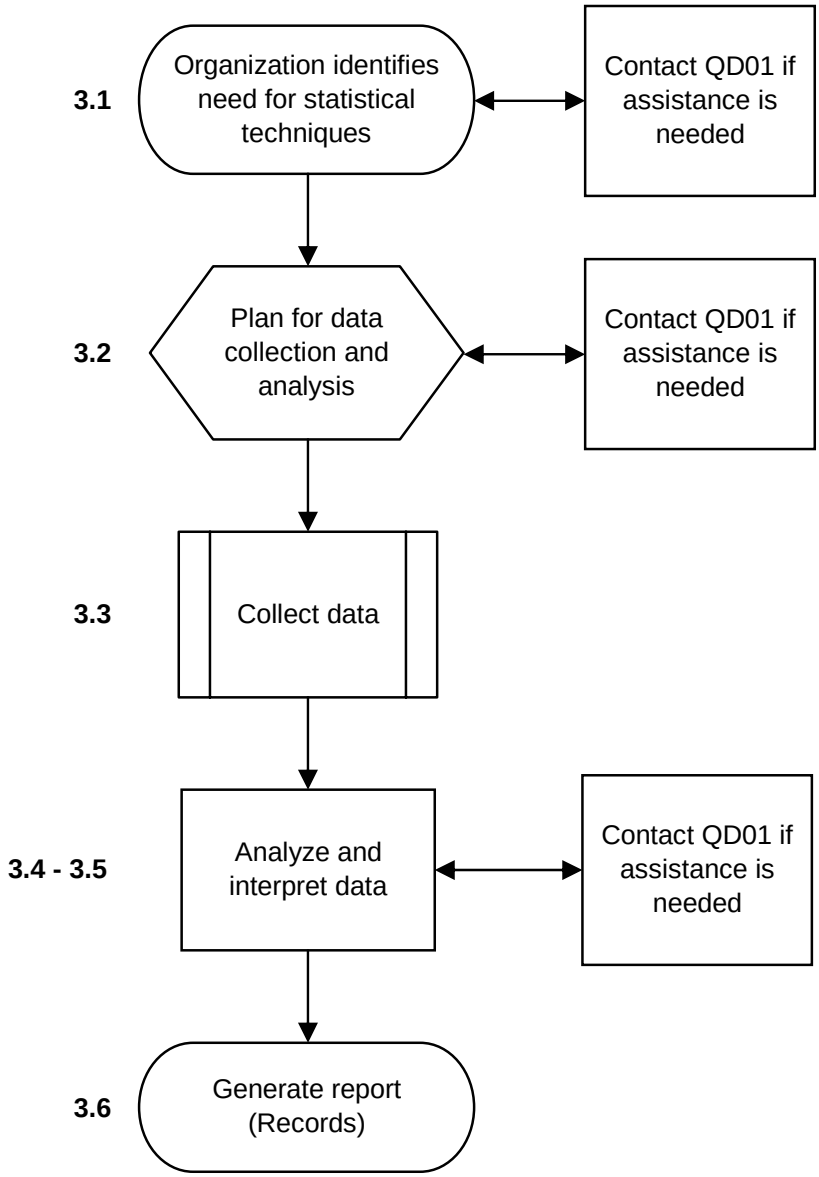
Actionee		Action
Any MSFC Organization	3.1	Shall identify a requirement for the use of statistical techniques.
STU or STU with QD01 assistance	3.2	Shall plan for data collection and analysis. This may include identifying any required or mandated analyses such as those required by Organizational Work Instructions (OWIs), plans, procedures, external references, etc. and planning to control those data and their analyses. This will often include choosing other specific analysis tools and constructing a data collection plan to accommodate this (DOE, level of significance, sample size determination, etc.). This may comprise simply choosing an appropriate statistical technique necessary to analyze the data. Note that this step and 3.2.1 sometimes follow step 3.3.
Any MSFC Organization	3.2.1	Where applicable, OWIs, plans, procedures, external references, etc. shall be used to implement and control the application of the statistical techniques.
STU	3.3	Shall identify and collect the necessary data.
STU or STU with QD01 assistance	3.4	Shall perform the statistical analysis on collected data using the appropriate statistical techniques.
STU or STU with QD01 assistance	3.5	Shall interpret the results from the statistical techniques.
STU	3.6	Shall generate reports to document data collected, statistical techniques used, and final results explanation.

4. RECORDS

The organization that generates a report on statistical techniques shall determine whether or not the report should be retained as a record (defined in MPR 1440.2). The organization shall define the retention of reports classified as records. If a record is to be retained, certain documents related to statistical analyses as outlined earlier in this MPR shall also be retained as part of that record.

5. FLOW DIAGRAM

The flow diagram represents the Statistical Techniques procedure activities outlined in Section 3. Note that planning steps often occur after data is collected.



STATISTICAL TECHNIQUES FLOW DIAGRAM

APPENDIX. Z – Guidance

QD01 is able to offer support to the needing organization in planning, execution and/ or analysis of statistical techniques. These include but are not limited to sampling, Design of Experiments (DOE), advanced data analysis, Probability of Detection (POD) and other areas. The use of statistical analysts can be considered before or during many steps in this process, as illustrated in the flow chart in section 5. It is recommended that a data analyst, whether from QD01 or from any other source, be involved in the setup of the experimental plan, acceptance sampling plan, database construction, or whatever plan will be used to facilitate data analysis. Getting the analyst involved early will ease the collection and analysis of the data, and often greatly improve the quality and usefulness of the data and analysis and at the same time reduce the time and expense.

In the case of acceptance sampling, knowledge of the hardware, requirements and other needs of various stakeholders is vital to the construction of a meaningful acceptance plan. It is thus again important to involve a statistician early in the planning process to gain full benefit of those services. It is important to note that any time less than 100% sampling is employed, there are risks (chance of accepting an unacceptable lot, for instance) that exist whether they are enumerated or not. The role of statistics is to evaluate these risks. In addition, there are cases where 100% sampling is different from full inspection. If there is any doubt, it is recommended that a statistician be involved in characterizing 100% sampling plans.